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(54) **MACHINE TOOL EQUIPPED WITH A QUICK COUPLING**

(57) A machine tool has a movable lifting arm 1 and a tool 21 coupled thereto. The lifting arm 1 has two coupling forks 5 and two movable coupling pins 7 that are coupled to the tool 21. The lifting arm 1 further has first hydraulic coupling pieces 11. The tool 21 has two coupling bars 23 to which the coupling forks 5 are coupled, two coupling eyes 25 into which the coupling pins 7 are inserted, and second hydraulic coupling pieces 27 to which the first hydraulic coupling pieces 11 are coupled. The tool 21 further has two pins 29 and 31 that are connected to each other, of which one pin 29 is moved by one of the coupling pins 7 during insertion into the coupling eye 25 and the other pin 31 depresses a switch 15, which switches on moving means 17 that move the first hydraulic coupling pieces 11 so that they are coupled with the second hydraulic coupling pieces 27 on the tool 21.

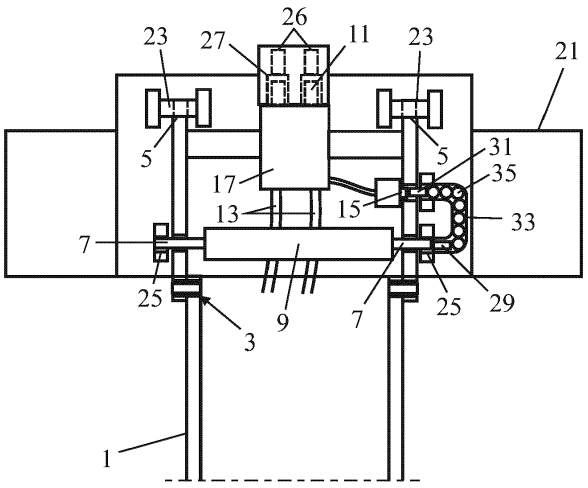

FIG. 6

EP 4 335 976 A1

Description

Technical field of the invention

[0001] The invention relates to a mobile machine tool comprising:

- a movable lifting arm provided with at least one hydraulic line,
- a tool that is coupled to the lifting arm and provided with hydraulically movable parts and at least one further hydraulic line,
- mechanical coupling means for coupling the tool with the lifting arm,
- hydraulic coupling means for coupling the hydraulic lines with each other,

whereby:

- the mechanical coupling means comprise:
    - at least one coupling eye attached to the tool, as well as
    - at least one coupling pin connected to the lifting arm, and
    - first moving means, connected to the lifting arm, for moving the coupling pin between a coupled position in the coupling eye and an uncoupled position out of the coupling eye,
- the hydraulic coupling means comprise:
    - a first coupling piece connected to the lifting arm, as well as
    - a second coupling piece attached to the tool, and
    - second moving means connected to the lifting arm, for moving the first coupling piece between a coupled position in which the coupling pieces are hydraulically coupled to each other and an uncoupled position in which the coupling pieces are disconnected from each other.

[0002] Various tools (attachments) can be hung in the lifting arm, such as a closed bucket, rubble bucket, pallet forks, stone clamp, lifting mast, stone rotator, sweeping broom, manure fork with top clamp, but also augers, mowers and feed dosing containers. Due to the possibility of connecting many different tools to the machine tool, the machine tool is suitable for many different applications.

Background of the invention

[0003] Such a machine tool is generally known in the form of a shovel provided with a quick coupling of which the mechanical and hydraulic coupling means form part and with which a tool can be quickly connected to or disconnected from the lifting arm. If the tool is not correctly mechanically connected to the lifting arm, the hydraulic coupling cannot be performed properly and there is a risk of damage to the hydraulic couplings.

[0004] The hydraulic coupling can only take place if the tool is mechanically coupled to the lifting arm in a correct manner. If a correct mechanical coupling has not taken place, the hydraulic coupling can be damaged when activated.

[0005] There is also a known quick coupling in which the risk of damage is small, but this known quick coupling requires that each tool be provided with a relatively expensive coupling module in order to cooperate with the coupling module at the free end of the lifting arm.

Summary of the invention

[0006] An object of the invention is to provide a machine tool of the type described in the opening paragraph in which the hydraulic coupling means are damaged less quickly and therefore need to be repaired less often and which does not require major adjustments to existing tools. To this end, the machine tool according to the invention is characterized in that it furthermore comprises:

- a switch present on the lifting arm for switching on the second moving means to move the first coupling piece to the coupled position, as well as
- a sensor present on the tool for detecting the presence of the coupling pin in the coupling eye,
- an actuator present on the tool for operating the switch present on the lifting arm for switching on the second moving means, and
- a transmission present on the tool between the sensor and the actuator and configured to activate the actuator as soon as the sensor detects the presence of the coupling pin in the coupling eye.

[0007] Because the second moving means for coupling the hydraulic coupling pieces together can only be activated if the coupling pin protrudes through the coupling eye, it is ensured that the hydraulic coupling only takes place in case the mechanical coupling has been carried out correctly. This greatly reduces the chance of the hydraulic couplings being damaged during coupling.

[0008] An important further advantage of the machine tool according to the invention is that it can cooperate with existing tools that are not provided with hydraulics without these existing tools having to be adapted. Existing tools are not equipped with switches, which means that the hydraulic coupling means on the lifting arm are not activated.

[0009] The second moving means for moving the first coupling piece can be hydraulic moving means, for example a piston present in a cylinder to which the first coupling piece is connected. These second moving means can, however, also be designed differently, such as pneumatic or electromechanical, for example a spindle driven by an electric motor that moves a spindle nut

present on the spindle along the spindle, which spindle nut is connected to the first coupling piece.

[0010] The transmission can be an electrical connection that transmits an electrical signal from the sensor to the actuator, but preferably the transmission is a mechanical transmission. A robust and reliable design of the mechanical transmission is characterized in that the transmission is formed by a lever, of which one end is present in or near the coupling eye and can be moved by the coupling pin and of which the other end is located near the switch and can press it.

[0011] The hydraulic coupling may only engage after the mechanical coupling has been established. The sensor detects the establishment of the mechanical coupling and activates the actuator via the transmission. The actuator operates the switch that activates the hydraulic coupling.

[0012] Another robust version of the mechanical transmission is characterized in that the transmission is formed by a tube filled with roller bodies that are against each other and have a diameter that is slightly smaller than the height of the tube and have a width that is slightly smaller than the width of the tube such that if a rolling body is pushed into the tube at one end of the tube, all rolling bodies in the tube will move, whereby the rolling body at the other end of the tube is pushed out of the tube, whereby in each end of the tube, a pin is present that can be partially moved in and out of the tube, one of pins forms the sensor and can move the rolling bodies in the tube and the other pin forms the actuator which can be moved by the rolling bodies, and where one of the ends of the tube is present in or near the coupling eye and the pin present in that end can be moved by the coupling pin and the other end of the tube is present near the switch and the pin in that end can press the switch. Preferably, the rolling bodies are formed by balls and the tube is designed as a tube with a circular cross-section. This ensures that a movement of one of the pins is transferred to a movement of the other pin without interference. This ensures reliable operation of the switch.

[0013] In the known machine tool, the hydraulic coupling means are located in the lower half of the free end of the lifting arm near the moving means for the coupling pin and they are also operated by the moving means for moving the coupling pin. The disadvantage of this is that the hydraulic coupling means regularly become contaminated or damaged by dirt or debris on the ground. As a result, the hydraulic coupling means often need to be cleaned or repaired.

[0014] An embodiment of the machine tool according to the invention in which there is less chance of contamination or damage is characterized in that the mechanical coupling means further comprise at least one coupling fork present on the lifting arm, as well as a coupling bar present on the tool and which, if the tool is coupled to the lifting arm, is coupled to the coupling fork, whereby the first and second hydraulic coupling pieces are closer to the coupling bar than to the coupling eye. Preferably the first and second hydraulic coupling pieces, seen in side view, are located at the location of the coupling bars. By installing the hydraulic coupling in the upper half near the coupling bars and coupling forks, there is less chance of contamination or damage.

[0015] The mechanical coupling means preferably comprise two parallel coupling forks of which said coupling fork forms part, as well as two in-line coupling bars of which said coupling bar forms part.

[0016] The mechanical coupling means preferably further comprise two in-line coupling pins that can be moved in opposite directions, of which said coupling pin forms a part, as well as two parallel coupling eyes of which said coupling eye forms a part.

Brief description of the drawings

[0017] The invention will be explained in more detail below on the basis of an exemplary embodiment of the machine tool according to the invention shown in the drawings, whereby:

Figure 1 shows the free end of the lifting arm provided with mechanical and hydraulic coupling means in a side view;
Figure 2 shows the free end of the lifting arm shown in figure 1 in top view;
Figure 3 shows the tool provided with mechanical and hydraulic coupling means in side view;
Figure 4 shows the tool shown in figure 3 in rear view;
Figure 5 shows the tool coupled to the lifting arm in side view with a first mechanical embodiment of the transmission;
Figure 6 shows the tool shown in figure 5 coupled to the lifting arm in rear view;
Figure 7 shows the tool shown in figure 5 coupled to the lifting arm in rear view with a second mechanical embodiment of the transmission; and
Figure 8 shows the tool shown in figure 5 coupled to the lifting arm in rear view with an electrical embodiment of the transmission.

Detailed description of the drawings

[0018] In Figures 1 and 2, a lifting arm 1 of a machine tool is shown in side view and in top view near the free end 3 of the lifting arm. In this embodiment the machine tool is a wheel loader of which only part of the lifting arm 1 is shown. The lifting arm 1 is provided at the free end 3 with mechanical and hydraulic coupling means for coupling with a tool.

[0019] The lifting arm 1 is connected at one end to a frame (not shown) of the machine tool and at the other, free end 3 is provided with mechanical coupling means for coupling to a tool. These mechanical coupling means are formed by two parallel coupling forks 5 and two movable coupling pins 7. To move these coupling pins 7, the lifting arm 1 is provided with moving means 9 formed by

a hydraulic cylinder in which pistons can be moved to which the coupling pins 7 are attached.

[0020] The free end 3 of the lifting arm 1 is further provided with hydraulic coupling means. These hydraulic coupling means are formed by first hydraulic coupling pieces 11 (tube pieces) that are present at the ends of hydraulic hoses 13. For moving the hydraulic coupling pieces 11, the lifting arm 1 is further provided with further moving means 17 that can slide the hydraulic coupling pieces 11 into and out of a housing. These further moving means 17 can be switched on by a switch 15 present on the lifting arm.

[0021] Figures 3 and 4 show a tool 21 designed as a shovel bucket in side view and in rear view. The tool 21 is also provided with mechanical and hydraulic coupling means. The mechanical coupling means of the tool 21 are formed by two coupling bars 23 with which the coupling forks 5 can be coupled and two coupling eyes 25 into which the coupling pins 7 can be inserted. The hydraulic coupling means are formed by second hydraulic coupling pieces 27 to which the first hydraulic coupling pieces 11 can be coupled. These second hydraulic coupling pieces 27 are also formed by pipe pieces into which the first hydraulic coupling pieces 11 can be slid. The second hydraulic coupling pieces 27 are connected via further hydraulic hoses 26 to hydraulic cylinders 28 for rotating the shovel bucket (these hydraulic cylinders are not shown in Figures 4 and 6).

[0022] The tool 21 further has a sensor and an actuator. The sensor is formed by a sensor pin 29 and the actuator by an actuator pin 31. The sensor pin 29 is present at the location of one of the coupling eyes 25 and is moved during coupling or uncoupling of the lifting arm 1 with the tool 21 by one of the coupling pins 7 during insertion into the coupling eye 25 or withdrawal from the coupling eye 25. The actuator pin 31 is located at a distance from the sensor pin 29 and - after moving the sensor pin 29 - operates the switch 15 that is present on the end of the lifting arm 1. The switch 15 switches on the further moving means 17, which move the first hydraulic coupling pieces 11 so that they are coupled to or disconnected from the second hydraulic coupling pieces 27 on the tool 21.

[0023] Between the sensor pin 29 and the actuator pin 31 there is a mechanical transmission formed by a tube 33 filled with balls 35. These balls are in contact with each other and have a diameter that is almost equal to the inner diameter of the tube 33. The sensor pin 29 and the actuator pin 31 are present in the ends of the tube 33 and are in contact with the balls 35 in the ends of the tube 33. When pressing the sensor pin 29 into the tube 33 through the coupling pin 7, the sensor pin 29 pushes the balls 35 through the tube 33 and at the other end of the tube the actuator pin 31 is partially pushed out of the tube 33. During this movement the switch 15 is actuated.

[0024] In Figures 5 and 6, the tool coupled to the lifting arm is shown in side view and in rear view. When coupling the lifting arm 1 with a tool 21, the coupling forks 5 are first slid around the coupling bars 23 by manipulating the lifting arm 1 and the coupling forks 5. The coupling forks 5 are then rotated until the coupling pins 7 are located in front of the coupling eyes 25 on the tool 21. The coupling pins 7 are then inserted into the coupling eyes 25 by the moving means 9. One of the coupling pins 7 pushes the sensor pin 29 further into the tube 33. This sensor pin pushes away the balls 35 present in the tube 33 and these balls 35 push the actuator pin 31 further out of the tube 33. This actuator pin presses the switch 15 on the lifting arm 1, which then switches on the further moving means 17. The further moving means 17 slide the hydraulic coupling pieces 11 from a coupling block (housing) present on the lifting arm 1 into the further hydraulic coupling pieces 27 that are present in a coupling block (housing) present on the tool 21. During the mechanical coupling of the lifting arm 1 with the tool 21, these two coupling blocks are positioned relative to each other with the coupling pieces 11 and 27 directly opposite each other.

[0025] Figure 7 shows the tool coupled to the lifting arm, but now provided with a second mechanical embodiment of the transmission. This transmission is formed by a lever 39. At one end of the lever there is a protrusion that forms the sensor and is in contact with one of the coupling pins 7 and at the other end of the lever there is a further protrusion that forms the actuator and is in contact with the switch 15. If the coupling pin 7 protrudes through the coupling eye 25, it turns the lever 39, which in turn presses the switch 15, causing the further moving means 17 to be activated.

[0026] Figure 8 shows the tool coupled to the lifting arm provided with an electrical embodiment of the transmission. The sensor is formed by a switch 43 of an electrical circuit 41 and the actuator is formed by an electrical contact 45 that is connected to the switch 15. If the coupling pin 7 protrudes through the coupling eye 25, it closes the electrical switch 43, causing a current to flow through the electrical circuit 41. Via the electrical contact 45, the switch 15 is supplied with power, which in turn activates the further moving means 17.

[0027] Although the invention has been elucidated in the foregoing with reference to the drawings, it should be noted that the invention is by no means limited to the embodiment shown in the drawings. The invention also extends to all embodiments deviating from the embodiment shown in the drawings within the scope defined by the claims.

Claims

1. Mobile machine tool comprising:

- a movable lifting arm (1) provided with at least one hydraulic line (13),
- a tool (21) that is coupled to the lifting arm (1) and provided with hydraulically movable parts and at least one further hydraulic line (26),

- mechanical coupling means for coupling the tool (21) with the lifting arm (1),
- hydraulic coupling means for coupling the hydraulic lines (13, 26) with each other,

whereby:

- the mechanical coupling means comprise:

  - at least one coupling eye (25) attached to the tool (21), as well as
  - at least one coupling pin (7) connected to the lifting arm (1), and
  - first moving means (9), connected to the lifting arm (1), for moving the coupling pin (7) between a coupled position in the coupling eye (25) and an uncoupled position out of the coupling eye (25),

- the hydraulic coupling means comprise:

  - a first coupling piece (11) connected to the lifting arm (1), as well as
  - a second coupling piece (27) attached to the tool (21), and
  - second moving means (17) connected to the lifting arm (1), for moving the first coupling piece (11) between a coupled position in which the coupling pieces (11, 27) are hydraulically coupled to each other and an uncoupled position in which the coupling pieces (11, 27) are disconnected from each other,

characterized in that the machine tool furthermore comprises:

- a switch (15) present on the lifting arm (1) for switching on the second moving means (17) to move the first coupling piece (11) to the coupled position, as well as
- a sensor (29) present on the tool (21) for detecting the presence of the coupling pin (7) in the coupling eye (25),
- an actuator (31) present on the tool (21) for operating the switch (15) present on the lifting arm (1) for switching on the second moving means (17), and
- a transmission present on the tool between the sensor (29) and the actuator (31) and configured to activate the actuator (31) as soon as the sensor (29) detects the presence of the coupling pin (7) in the coupling eye (25).

2. Machine tool according to claim 1, **characterized in that** the transmission is a mechanical transmission.

3. Machine tool according to claim 2, **characterized in that** the transmission is formed by a lever (39), of which one end is present in or near the coupling eye (25) and can be moved by the coupling pin (7) and of which the other end is located near the switch (15) and can press it.

4. Machine tool according to claim 2, **characterized in that** the transmission is formed by a tube (33) filled with roller bodies (35) that are against each other and have a diameter that is slightly smaller than the height of the tube (33) and have a width that is slightly smaller than the width of the tube (33) such that if a rolling body (35) is pushed into the tube (33) at one end of the tube, all rolling bodies (35) in the tube will move, whereby the rolling body at the other end of the tube is pushed out of the tube (33), whereby in each end of the tube (33), a pin (29, 31) is present that can be partially moved in and out of the tube (33), one of pins forms the sensor (29) and can move the rolling bodies (35) in the tube (33) and the other pin forms the actuator (31) which can be moved by the rolling bodies (35), and where one of the ends of the tube (33) is present in or near the coupling eye (25) and the pin (29) present **in that** end can be moved by the coupling pin (7) and the other end of the tube (33) is present near the switch (15) and the pin (31) **in that** end can press the switch (15).

5. Machine tool according to any one of the preceding claims, **characterized in that** the mechanical coupling means further comprise at least one coupling fork (5) present on the lifting arm (1), as well as a coupling bar (23) present on the tool and which, if the tool is coupled to the lifting arm, is coupled to the coupling fork (5), whereby the first and second hydraulic coupling pieces (11, 27) are closer to the coupling bar (23) than to the coupling eye (25).

6. Machine tool according to claim 5, **characterized in that**, seen in side view, the first and second hydraulic coupling pieces (11, 27) are present at the location of the coupling bars (23).

7. Machine tool according to claim 5 or 6, **characterized in that** the mechanical coupling means comprise two parallel coupling forks (5), of which said coupling fork forms part, as well as two in-line coupling bars (23) of which said coupling bar forms part.

8. Machine tool according to any one of the preceding claims, **characterized in that** the mechanical coupling means comprise two in-line coupling pins (7) that can be moved in opposite directions, of which said coupling pin forms part, as well as two parallel coupling eyes (25) of which said coupling eye forms part.

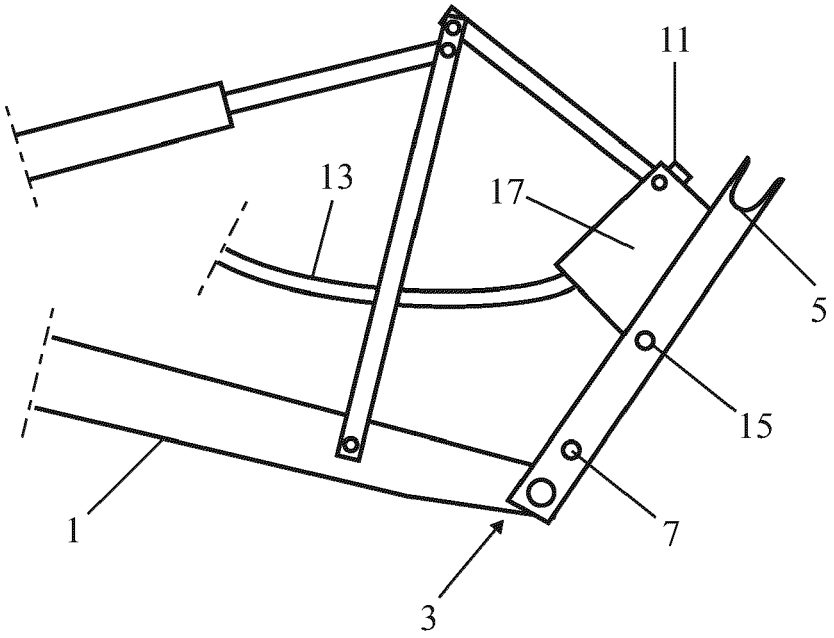

FIG. 1

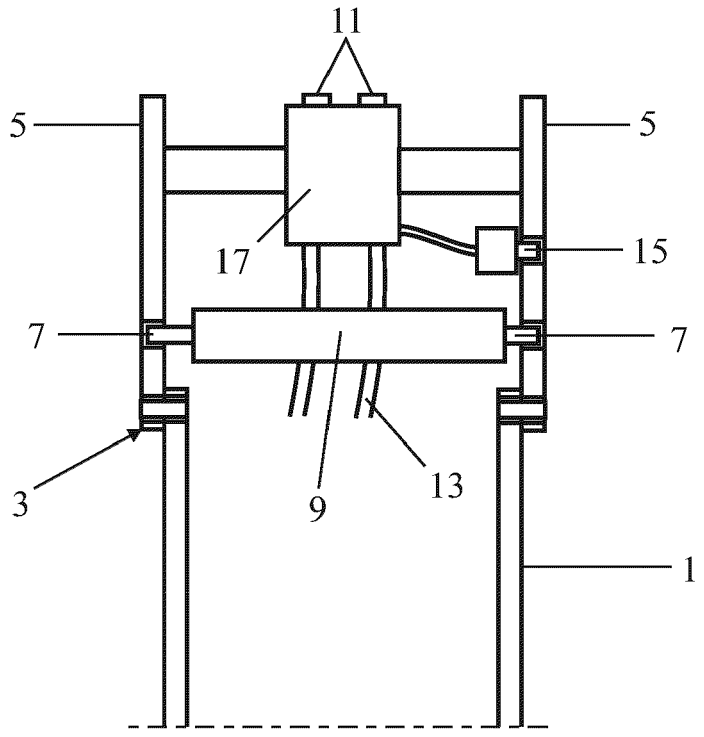

FIG. 2

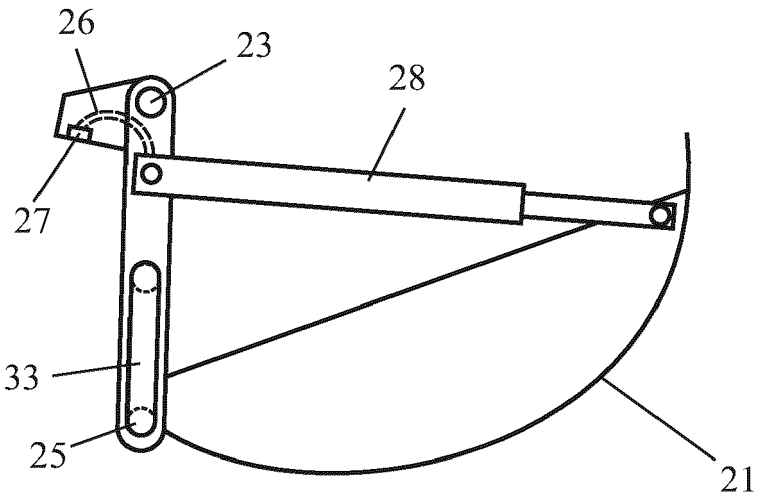

FIG. 3

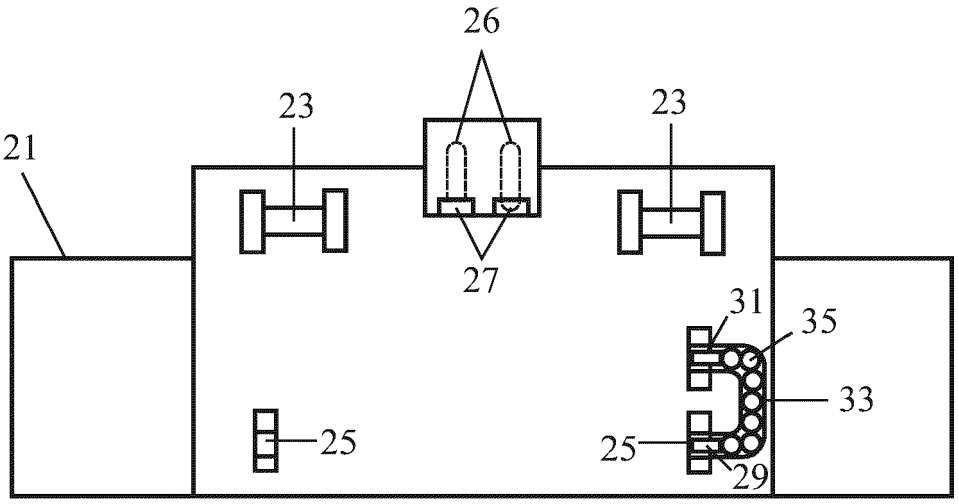

FIG. 4

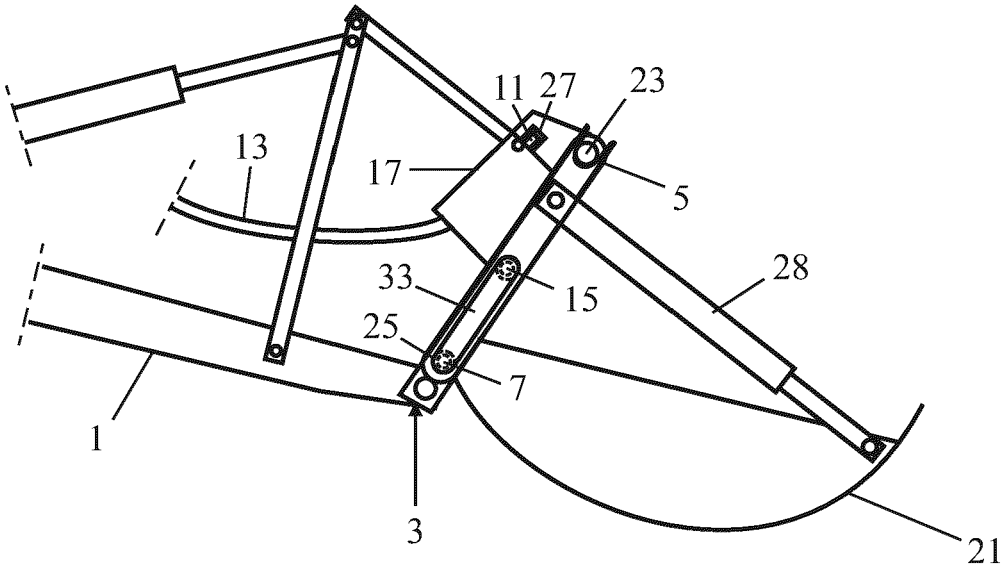
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FIG. 5

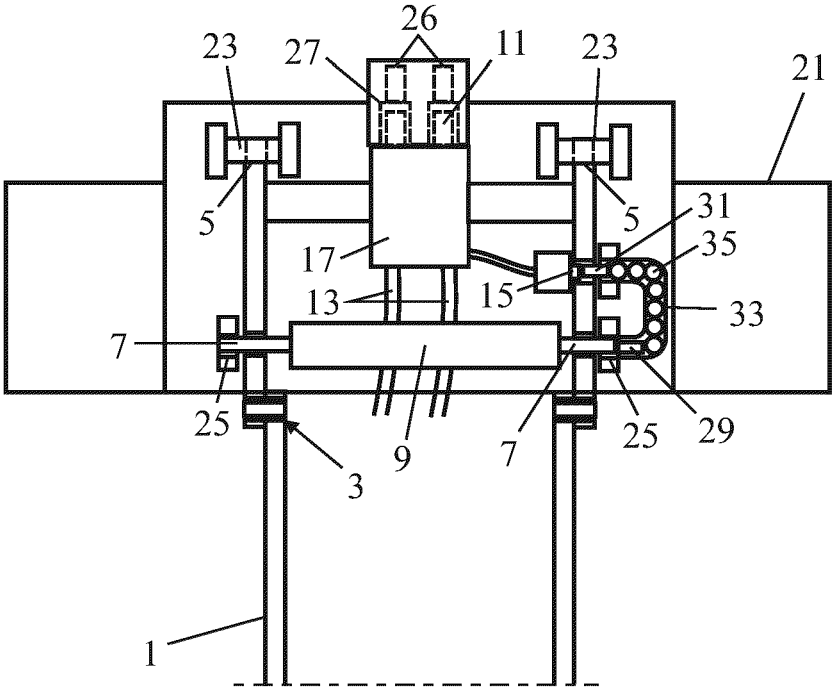
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FIG. 6

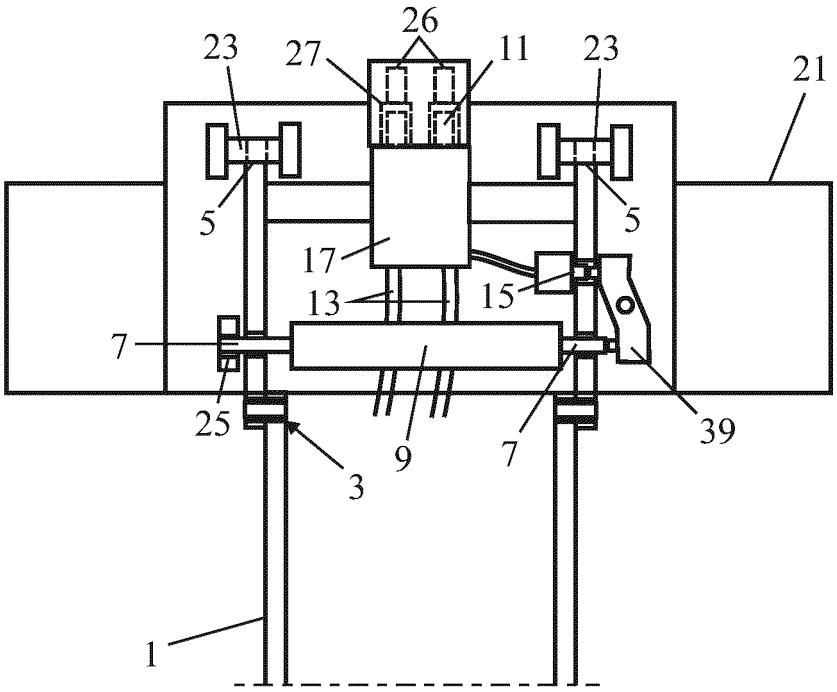
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FIG. 7

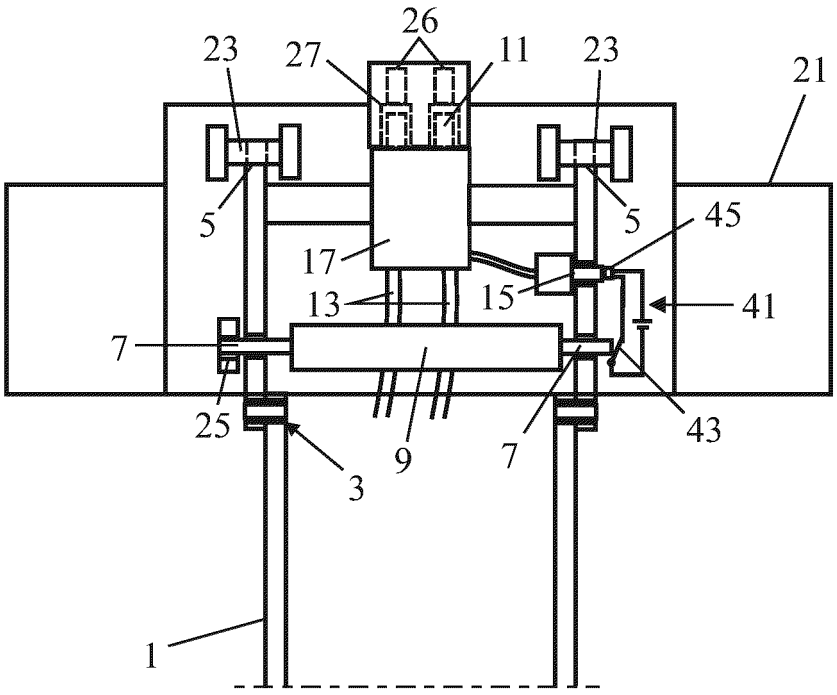
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FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 6078

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A	US 2018/171576 A1 (WEBB ADRIAN [GB] ET AL) 21 June 2018 (2018-06-21) * paragraphs [0021] - [0024], [0030]; figure 2 *	1-8	TECHNICAL FIELDS SEARCHED (IPC) E02F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 December 2023	Kühn, Thomas

CATEGORY OF CITED DOCUMENTS

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